

LISTING OF CLAIMS

1. (Original) A method of identifying an anatomical site for treatment comprising:
implanting at least one permanent marker at the anatomical site, the marker comprising a solid material that is detectable in and compatible with images formed by at least two imaging modalities, wherein one of the imaging modalities comprises a magnetic field imaging modality;
forming at least one image of the anatomical site, in which the marker is detectable and compatible, to obtain information about the anatomical site; and
treating the anatomical site using the information obtained from the at least one image of the anatomical site.
2. (Original) The method of claim 1 wherein the magnetic field imaging modality comprises a magnetic resonance imaging modality.
3. (Original) The method of claim 1 wherein the marker does not cause substantial spectral distortion under MRS.
4. (Original) The method of claim 1 wherein one of the imaging modalities comprises a non-magnetic field imaging modality.
5. (Original) The method of claim 4 wherein the non-magnetic field imaging modality comprises a radiation imaging modality or an ultrasound imaging modality.
6. (Original) The method of claim 5 wherein the radiation imaging modality comprises an X-ray imaging modality.
7. (Original) The method of claim 6 wherein the X-ray imaging modality comprises fluoroscopy or mammography.

8. (Original) The method of claim 1 wherein one of the imaging modalities comprises a magnetic resonance imaging modality and one comprises an X-ray imaging modality or an ultrasound imaging modality.
9. (Original) The method of claim 1 wherein the marker is detectable in and compatible with images formed by at least 3 imaging modalities.
10. (Original) The method of claim 9 wherein one of the imaging modalities comprises an ultrasound imaging modality and one comprises a radiation imaging modality.
11. (Original) The method of claim 10 wherein the radiation imaging modality comprises an X-ray imaging modality.
12. (Original) The method of claim 11 wherein the X-ray imaging modality comprises fluoroscopy or mammography.
13. (Original) The method of claim 9 wherein one of the imaging modalities comprises a magnetic resonance imaging modality, one comprises an ultrasound imaging modality and one comprises a radiation imaging modality.
14. (Original) The method of claim 1 wherein treating the anatomical site comprises monitoring the anatomical site using information obtained from the at least one image.
15. (Original) The method of claim 1 wherein treating the anatomical site comprises mapping the anatomical site using information obtained from the at least one image.
16. (Original) The method of claim 1 wherein treating the anatomical site comprises performing radiation therapy, drug therapy or surgery at the anatomical site.

17. (Original) The method of claim 1 where treating the anatomical site comprises performing a tissue removal or biopsy procedure.
18. (Original) The method of claim 1 wherein treating the anatomical site comprises evaluating the anatomical site after performing a medical procedure on the anatomical site.
19. (Original) The method of claim 1 wherein the marker is implanted at the anatomical site before, after or during a tissue removal or biopsy procedure.
20. (Original) The method of claim 1 wherein the implanting step comprises guiding the marker to the anatomical site by forming at least one image using an ultrasound, radiation or magnetic field imaging modality.
21. (Original) The method of claim 1 wherein the implanting step comprises implanting a plurality of markers into a body comprising the anatomical site, wherein at least one of the markers is implanted at the anatomical site.
22. (Original) The method of claim 1 wherein at least one image is formed by a magnetic field imaging modality, a radiation imaging modality or an ultrasound imaging modality.
23. (Original) The method of claim 1 further comprising forming at least a second image of the anatomical site, in which the marker is detectable in and compatible with, to obtain information about the anatomical site.
24. (Original) The method of claim 23 wherein at least one of the images is formed by magnetic resonance imaging.

25. (Original) The method of claim 23 wherein the second image is formed before, during or after treating the anatomical site.
26. (Original) The method of claim 1 wherein the information obtained from the at least one image comprises diagnostic information, positional information, or condition information about the anatomical site.
27. (Original) The method of claim 1 wherein the marker further comprises an additional material visible in an additional imaging modality.
28. (Original) The method of claim 27 wherein the additional imaging modality comprises an electronic portal imaging modality or a portal film imaging modality.
29. (Original) The method of claim 1 wherein the marker further comprises a biologically active agent.
30. (Original) The method of claim 1 further comprising injecting a carrier solution at the anatomical site before, after or during the implantation of the marker.
31. (Original) The method of claim 30 wherein the carrier solution comprises a glucan, collagen, saline, dextran, glycerol, polyethylene glycol, corn oil, safflower, polysaccharide, biocompatible polymer, methyl cellulose, agarose, hemostatic agent, protein or combinations thereof.
32. (Original) The method of claim 30 wherein the carrier solution comprises a β -glucan.
33. (Original) A method for mapping a portion of a body by multi-modality fusion comprising:

implanting at least one permanent tissue marker in the body, the marker comprising a solid material that is detectable in and compatible with images formed by at least two imaging modalities, wherein one of the imaging modalities comprises a magnetic field imaging modality;

forming a first image, in which the marker is detectable and compatible, using a first imaging modality;

forming a second image, in which the marker is detectable and compatible, using a second imaging modality, wherein one of the first and second imaging modalities is a magnetic field imaging modality; and

synthesizing the first and second images to obtain positional information for a portion of the body.

34. (Original) The method of claim 33 wherein the synthesizing step comprises synthesizing the first and second images using a computer system.

35. (Original) A method of positioning a body for radiation therapy comprising:
selecting an anatomical site upon which radiation therapy is to be performed;
implanting at least one permanent marker at the anatomical site, the marker comprising a solid material that is detectable in and compatible with images formed by at least two imaging modalities, wherein one of the imaging modalities comprises a magnetic field imaging modality;

forming at least one image of the anatomical site, in which the marker is detectable and compatible, to obtain information about the anatomical site; and

positioning the body for radiation therapy based on information provided by the at least one image.

36. (Original) The method of claim 35 further comprising:

forming at least two images of the anatomical site, in which the marker is detectable and compatible, to obtain information about the anatomical site; and

comparing information provided by the at least two images prior to performing radiation therapy.

37. (Original) The method of claim 36 wherein the comparing step comprises detecting positional differences between the at least two images.

38. (Original) The method of claim 36 comprising affecting the position of the patient based on the positional differences between the images.

39. (Original) The method of claim 35 further comprising pre-positioning the body for radiation therapy prior to forming the at least one image.

40. (Original) The method of claim 35 wherein the forming and positioning steps are performed at a plurality of radiation therapy sessions.

41. (Original) The method of claim 35 further comprising performing radiation therapy on the anatomical site.

42. (Original) A method of identifying a lesion site of a breast for treatment comprising:

implanting a marker at the lesion site comprising a solid material that is detectable in and compatible with images formed by at least two imaging modalities, wherein one of the imaging modalities comprises a magnetic field imaging modality;

forming at least one image of the lesion site, in which the marker is detectable and compatible, to obtain information about the lesion site; and

treating the lesion site using information obtained from the image.

43. (Original) The method of claim 42 wherein treating the lesion comprises monitoring the lesion.

44. (Original) The method of claim 42 wherein treating the lesion comprises removing the lesion from the breast.
45. (Original) The method of claim 42 wherein at least one image of the lesion site is formed by an MR mammography imaging modality.
46. (Original) A method for performing computer assisted diagnosis to provide diagnostic information about a patient comprising:
implanting at least one permanent marker at an anatomical site in the patient, the marker comprising at least one solid material that is not categorized as abnormal tissue during computer assisted diagnosis; and
performing computer assisted diagnosis to obtain diagnostic information about the anatomical site.
47. (Original) The method of claim 46 further comprising treating the anatomical site based on the diagnostic information.
48. (Original) The method of claim 47 wherein treating the anatomical site comprises performing radiation therapy.
49. (Original) A permanently implantable biocompatible marker comprising at least one solid material that is detectable in and compatible with images formed by at least two imaging modalities, wherein one of the at least two imaging modalities is a magnetic field imaging modality, and wherein the marker is shaped to be distinguishable from anatomical features in images formed by the imaging modalities.
50. (Original) The marker of claim 49 wherein the magnetic field measuring imaging modality comprises a magnetic resonance imaging modality.

51. (Original) The marker of claim 49 wherein the solid material is compatible with images formed by a radiation imaging modality or an ultrasound imaging modality.
52. (Original) The marker of claim 51 wherein the radiation imaging modality comprises X-ray.
53. (Original) The marker of claim 52 wherein the X-ray imaging modality comprises fluoroscopy or mammography.
54. (Original) The marker of claim 49 wherein the solid material is detectable in and compatible with images formed by at least 3 imaging modalities.
55. (Original) The marker of claim 54 wherein one of the imaging modalities comprises a radiation imaging modality and one comprises ultrasound.
56. (Original) The marker of claim 55 wherein the radiation imaging modality comprises an X-ray imaging modality.
57. (Original) The marker of claim 49 wherein the solid material comprises a ceramic material or graphite.
58. (Original) The marker of claim 57 wherein the ceramic material comprises zirconium oxide.
59. (Original) The marker of claim 57 wherein the ceramic material comprises aluminum oxide, hydroxyapatite, silicon dioxide or combinations thereof.

60. (Original) The marker of claim 49 wherein the solid material is coated with a biocompatible coating.
61. (Original) The marker of claim 60 wherein the biocompatible coating comprises a carbon coating or a carbon resin coating.
62. (Original) The marker of claim 61 wherein the carbon coating comprises pyrolytic carbon, vitreous carbon or graphite.
63. (Original) The marker of claim 49 comprising a zirconium oxide substrate and a carbon coating.
64. (Original) The marker of claim 49 comprising a major dimension between about 80 and about 10,000 microns.
65. (Original) The marker of claim 49 comprising a major dimension between about 800 and about 3,500 microns.
66. (Original) The marker of claim 49 comprising a major dimension between about 1,000 and about 3,000 microns.
67. (Original) The marker of claim 49 wherein the marker is shaped as a dog bone, barbell, ring, helix, tube, circle, oval or sphere.
68. (Original) The marker of claim 49 wherein the marker comprises a hollow portion.
69. (Original) The marker of claim 68 wherein the hollow portion is filled with a liquid.

70. (Original) The marker of claim 49 further comprising an additional material detectable in and compatible with at least an additional imaging modality.
71. (Original) The marker of claim 70 wherein the additional material comprises a radiopaque material.
72. (Original) The marker of claim 70 wherein the additional material comprises gold, titanium, platinum, palladium, gadolinium, or tantalum.
73. (Original) The marker of claim 70 wherein the additional material is applied as a coating.
74. (Original) The marker of claim 49 wherein the marker further comprises a biologically active agent disposed on a surface of the marker.
75. (Original) The marker of claim 74 wherein the biologically active agent is a biologically active gel.
76. (Original) The marker of claim 74 wherein the biologically active agent is an anti-inflammatory, anti-microbial, a hemostatic agent, a biocompatible adhesive agent, or a cell-derived agent.
77. (Original) A kit for marking an anatomical site comprising:
at least one marker for permanent implantation into the anatomical site comprising a solid material that is detectable in and compatible with images formed by at least two imaging modalities, wherein one of the imaging modalities is a magnetic field imaging modality, and wherein the marker is shaped to be distinguishable from features of the anatomical site; and

a carrier solution for delivery to the anatomical site.

78. (Original) The kit of claim 77 wherein the carrier solution comprises β -glucan.